

## **AMENDMENTS TO THE CLAIMS:**

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A method of simulating an industrial process comprising the steps of:

storing model data indicative of a plurality of processes involving a number of items of equipment to be used in an industrial process to be simulated;

initiating a first simulated batch for simulated processing;

generating scheduling data for scheduling the initiation of simulated batches after the initiation of said first simulated batch by, when simulated processing of a latest initiated batch is initiated:

identifying items of equipment liable to be involved in simulated processing of a next batch to be initiated after said latest initiated batch;

utilizing said stored model data to determine for each item of said identified items of equipment a minimum possible simulated processing time required for simulated processing of said latest initiated batch;

determining for said identified items of equipment which are currently in use for processing batches currently being processed, the greatest time of use of previously simulated in processing batches using said items of equipment; and

generating scheduling data for the next batch to be initiated after the latest initiated batch to cause the time between the initiation of said latest initiated batch and said next batch within said simulation to be equal to the greater of the

maximum of said minimum process times for said items of equipment involved in simulated processing of said next batch and said greatest time of use for said identified items of equipment currently in use

~~determining scheduling data for initiating batches against which said processes are to be simulated; and~~

generating output data indicative of a simulation of an industrial process utilising utilizing said stored model data and said generated scheduling data,

~~characterised in that said determination of scheduling data comprises the steps of:~~

~~determining a minimum possible processing time for each item of equipment involved in simulated processing of an initiated batch in accordance with said model data;~~

~~determining for batches currently being processed the greatest time of use of items of equipment utilised in processing said batches; and~~

~~generating scheduling data for scheduling the initiation of the next batch after said initiated batch, said scheduling data being such to cause the time between an initiated batch and said next batch within said simulation to be equal to the greater of the maximum of said minimum process times for said items of equipment and said greatest time of use for said items of equipment.~~

2. (Currently Amended) A method in accordance with claim 1, wherein said determination of the greatest time of use of an item of equipment ~~utilised~~ utilized in processing comprises the steps of:

storing in association with each item of equipment to be simulated data indicative of the time of use of said item of equipment for a batch previously processed by said item of equipment; and

determining as the greatest time of use the greatest time of use of said stored times of use.

3. (Original) A method in accordance with claim 1, wherein said determining of the greatest time of use of an item of equipment further comprises for each of the said items of equipment the steps of:

determining whether an item of equipment is in use; and if an item of equipment is in use determining the total time the item of equipment has been in use for a current batch; and if an item of equipment is no longer in use storing said total time in use as said time in use for said equipment.

4. (Original) A method in accordance with claim 3, wherein each of said items of equipment is associated with a number of processes wherein said determination of whether an item of equipment is in use comprises determining whether any of said processes associated with said item of equipment is currently being simulated.

5. (Currently Amended) A method in accordance with claim 1, wherein said determining of a minimum possible processing time of an initiated batch comprises the step of storing in association with each batch to be initiated data indicative of the greatest of said minimum possible processing times; and said generation step comprises ~~utilising~~ utilizing said data to generate scheduling data.

6. (Currently Amended) A method in accordance with claim 1, wherein said determination of a minimum possible processing time comprises the steps of:

associating with a batch to be initiated data to be indicative of the items of equipment to be ~~utilised~~ utilized in simulated processing of said batch; and

determining said minimum possible processing times for each item of equipment associated with said batch.

7. (Currently Amended) A method in accordance with claim 6, wherein each of the said items of equipment is associated with a number of processes, each of said processes ~~having~~ being associated therewith ~~a~~ with data identifying one or more completion ~~condition~~ conditions for that process, at the least some of said processes being associated with data identifying one or more completion conditions including ~~comprising~~ the lapse of specified time period in the simulation of a process, wherein said determination of a minimum possible processing time for an item of equipment comprises determining the sum of said specified time periods for said processes of said items of equipment.

8. (Currently Amended) A method in accordance with claim 7, wherein said storage step further comprises associating with at least some of said plurality of processes involving said items of equipment, rate data identifying the respective associated process as utilizing a utility at a rate and said generation of output data comprises for each step in a simulation the steps of:

determining whether any process of said plurality of processes to be simulated is associated with rate data;

determining the minimum time increment step size required to complete any of the processes currently being simulated; and

selecting as a time increment step size for generating output data a default time increment step size, if at least one process associated with rate data is to be simulated and said default time increment step size is smaller than said determined minimum time increment step size, and selecting as said time increment step size said determined minimum time increment step size if no process to be simulated is associated with rate data or said default time increment step size is greater than said determined minimum time increment step size.

9. (Currently Amended) A method of simulating an industrial process comprising the steps of:

storing model data indicative of a plurality of processes involving a number of items of equipment to be used in an industrial process to be simulated;

determining a time increment step size to be used with said model data; and  
generating output data indicative of a step within a simulation of an industrial process ~~utilising~~ utilizing said stored model data and said determined time increment step size, ~~characterised~~ characterized in that said storage step comprises the step of storing rate data in relation to at least some of said processes, and  
that said determination step comprises for each step in a simulation; the steps of:  
determining whether any process of said plurality of processes to be simulated is associated with rate data identifying the respective associated process as utilizing a utility at a rate;  
determining the minimum time increment step size required to complete any of the processes currently being simulated; and  
selecting as a time increment step size for generating output data a default time increment step size, if at least one process associated with rate data is to be simulated and said default time increment step size is smaller than said determined minimum time increment step size, and selecting as said time increment step size said determined minimum time increment step size if no process to be simulated is associated with rate data or said default time increment step size is greater than said determined minimum time increment step size.

10. (Currently Amended) A method in accordance with claim 8, wherein said storage step further comprises associating with said at least some of said plurality of processes, utility type data, and said generation of output data comprises for steps in a

simulation generating output data associated with items of utility type data utilizing rate data associated with a process being simulated and said determined time increment step size.

11. (Original) A method in accordance with claim 10, wherein said generation of output data comprises for steps in a simulation determination of output data representative of instantaneous demand for a utility corresponding to an item of utility type data utilizing determined sums of rate data associated with said utility type data for processes being simulated.

12. (Currently Amended) A method in accordance with claim 10, wherein said generation of output data for steps within a simulation comprises storing in association with items of utility data, quantity data indicative of a current quantity of a utility within a simulation wherein said quantity data is determined utilizing rate data associated with processes being simulated and said determined time increment step size.

13. (Currently Amended) A method in accordance with claim 12, wherein said quantity data for a step in a simulation is determined by incrementing or decrementing quantity data associated with utility type data for the previous step in a simulation by the product of said determined time increment step size and the sum of rate data associated with said utility data and processes being simulated.

14. (Currently Amended) A method in accordance with claim 13, wherein said storage step further comprises storing in association with said items of utility type data, minimum quantity data and generation rate data, wherein the determination of quantity data associated with an item of utility type data for a step within a simulation comprises the step of incrementing or decrementing quantity data for the previous step in a simulation by the product of said generation rate data and said determined time increment step size if said quantity data is less than said minimum quantity data associated with said utility type.

15. (Currently Amended) A method in accordance with claim 14, wherein said storage step further comprises storing in association with said items of utility type data, maximum quantity data wherein the determination of quantity data associated with an item of utility type data for a step within a simulation comprises the step of incrementing or decrementing quantity data for the previous step in a simulation by the product of said generation rate data and said determined time increment step size only when said quantity data associated with said utility type does not exceed said maximum quantity data associated with said utility type.

16. (Original) A method in accordance with claim 10, wherein said generated output data associated with utility type data comprises data indicative of the simulated availability of utilities or waste processing capacity.



17. (Currently Amended) A method in accordance with claim 12, wherein said storage step comprises storing in association with at least some of said plurality of processes, data indicative of a one or more continuation conditions, and said generation of output data comprises for each step in a simulation, the steps of:

determining which of said plurality of processes are to be simulated in said step of said simulation;

determining for processes to be simulated associated with data indicative of a one or more continuation conditions whether output data generated for the previous step in said simulation ~~fulfils~~ fulfills the one or more continuation conditions defined by said data; and

if ~~[[a]]~~ at least one continuation condition for a process being simulated is not fulfilled simulating a delay in the continued processing of said process.

18. (Currently Amended) A method of simulating an industrial process comprising the steps of:

storing model data indicative of a plurality of processes involving a number of items of equipment to be used in an industrial process to be simulated; and

generating output data indicative of a simulation of an industrial process utilizing said stored model data, ~~characterised~~ characterized in that said storage step comprises storing ~~in association with at least some of said plurality of processes,~~ data indicative of ~~[[a]]~~ one or more continuation conditions in association with each of said processes, and said generation of output data comprises for each step in a simulation, the steps of:

determining which of said plurality of processes are to be simulated in said step of said simulation;

determining for the processes to be simulated ~~associated with data indicative of a continuation condition~~ whether output data generated for the previous step in said simulation fulfils the one or more continuation conditions defined by ~~said the stored data~~ associated with said processes being simulated; and

if ~~[[a]]~~ at least one continuation condition ~~for associated with~~ a process being simulated is not fulfilled by said generated output data simulating a delay in the continued processing of said process.

19. (Currently Amended) A method in accordance with claim 17, wherein said data indicative of ~~[[a]]~~ one or more continuation conditions associated with a process comprises data defining an equation which quantity data associated with utility type data is required to fulfill.

20. (Currently Amended) A method in accordance with claim 17, wherein said storage step comprises storing data in association with each of said plurality of processes indicative of the next processes to be simulated following the completion of each said process wherein said determination of which of said plurality of processes are to be simulated comprises the steps of:

determining for each process simulated in the previous step of a simulation whether the one or more completion continuation conditions associated with each said process being simulated have ~~has~~ been fulfilled; and

determining as processes to be simulated;

processes being simulated for which not all of the continuation ~~said completion~~ conditions have ~~not~~ been fulfilled and said the processes identified by said stored data as next processes to be simulated which are associated with simulated processes for which said all of completion conditions associated with those processes have been fulfilled.

21. (Currently Amended) A method of performing an industrial process comprising the steps of:

simulating an industrial process in accordance with any ~~preceding claim~~ one of claims 1, 9 or 18 to determine apparatus required to perform a process;

providing apparatus corresponding to said items of equipment simulated; and  
utilizing said apparatus to perform said industrial process simulated.

22. (Currently Amended) An apparatus for generating a simulation of an industrial process comprising:

storage means for storing model data indicative of a plurality of processes involving a number of items of equipment to be used in an industrial process to be simulated;

determination means for determining scheduling data for initiating batches against which said processes are to be simulated;

an equipment identifier operable to identify items of equipment liable to be involved in simulated processing of a next batch to be initiated after a latest initiated batch;

a minimum cycle time determination unit operable to determine for items of equipment identified by said equipment identifier a minimum possible simulated time required by each identified item of equipment for processing said latest initiated batch;

a current cycle time determination unit operable to determine for each item of equipment identified by said equipment identifier, the greatest time of use for processing previously initiated batches;

a scheduling unit operable to generate scheduling data for scheduling the initiation of a next batch to be initiated after the initiation of a latest initiated batch, said scheduling unit being arranged to cause the time between the initiation of a next batch to be initiated after a latest initiated batch to be equal to the greater of the maximum of the minimum processing times said minimum cycle time determination unit and the greatest time in use determined by said current cycle time determination unit for items of equipment identified as being liable to process said batch to be scheduled; and

generation means for generating output data indicative of a simulation of an industrial process ~~utilising~~ utilizing stored model data and ~~determined~~-scheduling data generated by said scheduling unit;

~~characterised in that said determination means comprises:~~

~~\_\_\_\_\_ means for determining a minimum possible processing time for each item of equipment involved in simulated processing of an initiated batch in accordance with stored model data;~~

~~\_\_\_\_\_ means for determining for batches currently being processed the greatest time of use of items of equipment utilised in processing said batches; and~~

~~\_\_\_\_\_ means for generating scheduling data for scheduling the initiation of the next batch after an initiated batch, said scheduling data being such to cause the time between an initiated batch and said next batch within a simulation to be equal to the greater of the maximum of said determined minimum process times for said items of equipment and said determined greatest time of use for said items of equipment.~~

23. (Currently Amended) An apparatus in accordance with claim 22, wherein said ~~means for determining~~ current cycle time determination unit ~~the greatest time of use of an item of equipment~~ comprises:

means for storing in association with each item of equipment to be simulated data indicative of the time of use of said item of equipment for a batch previously processed by said item of equipment, said ~~means for determining the greatest time of use~~ current cycle time determination unit being arranged to determine as the greatest time of use the greatest time of use of said stored times of use stored in said means for storing.

24. (Currently Amended) An apparatus in accordance with claim 22, wherein said ~~means for determining of the greatest time of use of an item of equipment~~ current

cycle time determination unit is arranged to determine for each of the said items of equipment identified by said equipment identifier whether an item of equipment is in use; and if an item of equipment is in use to determine the total time the item of equipment has been in use for a current batch; and if an item of equipment is no longer in use to store said total time in use as said time in use for said equipment.

25. (Currently Amended) An apparatus in accordance with claim 24, wherein said storage means is arranged to store model data associating each of said items of equipment with a number of processes wherein said ~~means for determining the greatest time of use of an item of equipment~~ current cycle time determination unit being arranged to determine whether any of said processes associated with an item of equipment is currently being simulated to determine whether an item of equipment is in use.

26. (Currently Amended) An apparatus in accordance with claim 22, wherein said ~~means for determining a minimum possible processing time~~ minimum cycle time determination unit comprises means for storing in association with each batch to be initiated data indicative of the greatest of said minimum possible processing times, said ~~determination means~~ minimum cycle time determination unit being arranged to utilize said data to generate scheduling data.

27. (Currently Amended) An apparatus in accordance with claim 22, wherein said minimum cycle time determination unit ~~means for determining a minimum possible~~

~~processing time~~ comprises: means for associating with a batch to be initiated data indicative of the items of equipment to be ~~utilized~~ utilized in simulated processing of said batch, said minimum cycle time determination unit ~~means for determining a minimum possible processing time~~ being arranged to utilize said data associated with said batch.

28. (Currently Amended) An apparatus in accordance with claim 27, wherein said storage means is arranged to associate said items of equipment with data indicative of a number of processes and data identifying one or more completion conditions for each of said processes ~~having associated therewith a completion condition~~, at the least some of said processes being associated with data identifying one or more completion conditions comprising including the lapse of specified time period in the simulation of a process, wherein said minimum cycle time determination unit ~~means for determining a minimum possible processing time for an item of equipment~~ is arranged to determine the sum of said specified time periods ~~for identified as completion conditions for said processes of associated with~~ identified as completion conditions for said processes of associated with said items of equipment.

29. (Currently Amended) An apparatus in accordance with claim 28, wherein said storage means is further arranged to associate with at least some of said plurality of processes, rate data and wherein said generation means further comprises:

means for determining whether any process of said plurality of processes to be simulated is associated with rate data identifying the respective associated process as utilizing a utility at a rate;

means for determining the minimum time increment step size required to complete any of the processes currently being simulated; and

selection means for selecting as a time increment step size for generating output data a default time increment step size, if at least one process associated with rate data is to be simulated and said default time increment step size is smaller than said determined minimum time increment step size, and selecting as said time increment step size said determined minimum time increment step size if no process to be simulated is associated with rate data or said default time increment step size is greater than said determined minimum time increment step size.

30. (Currently Amended) An apparatus for generating a simulation of an industrial process comprising:

storage means for storing model data indicative of a plurality of processes involving a number of items of equipment to be used in an industrial process to be simulated;

means for determining a time increment step size to be used with said model data; and

generation means for generating output data indicative of a step within a simulation of an industrial process ~~utilising~~ utilizing said stored model data and a determined time increment step size, ~~characterised~~ characterized in that said storage means is arranged to store rate data in relation to at least some of said processes, and that said means for determining a time increment step size comprises:



means for determining whether any process of said plurality of processes to be simulated is associated with rate data identifying the respective associated process as utilizing a utility at a rate;

means for determining the minimum time increment step size required to complete any of the processes currently being simulated; and

selection means for selecting as a time increment step size for generating output data a default time increment step size, if at least one process associated with rate data is to be simulated and said default time increment step size is smaller than said determined minimum time increment step size, and selecting as said time increment step size said determined minimum time increment step size if no process to be simulated is associated with rate data or said default time increment step size is greater than said determined minimum time increment step size.

31. (Currently Amended) An apparatus in accordance with claim 29, wherein said storage means is further arranged to associate with said at least some of said plurality of processes, utility type data, and said generation means is arranged to output data associated with items of utility type data utilizing rate data associated with a process being simulated and said determined time increment step size.

32. (Original) An apparatus in accordance with claim 31, wherein said generation means is arranged to output data representative of instantaneous demand for a utility

corresponding to an item of utility type data utilizing determined sums of rate data associated with said utility type data for processes being simulated.

33. (Currently Amended) An apparatus in accordance with claim 31, wherein said storage means is arranged to store in association with items of utility data, quantity data indicative of a current quantity of a utility within a simulation, and wherein said generation means is arranged to output quantity data is determined utilizing rate data associated with processes being simulated and said determined time increment step size.

34. (Currently Amended) An apparatus in accordance with claim 31, wherein said generation means is arranged to determine quantity data for a step in a simulation by incrementing or decrementing quantity data associated with utility type data for the previous step in a simulation by the product of said determined time increment step size and the sum of rate data associated with said utility data and processes being simulated.

35. (Currently Amended) An apparatus in accordance with claim 34, wherein said storage means is further arranged to store in association with said items of utility type data, minimum quantity data and generation rate data, wherein said generation means is arranged to output quantity data associated with an item of utility type data for a step within a simulation by incrementing or decrementing quantity data for the

previous step in a simulation by the product of said generation rate data and said determined time increment step size if said quantity data is less than said minimum quantity data associated with said utility type.

36. (Currently Amended) An apparatus in accordance with claim 35, wherein said storage means is further arranged to store in association with said items of utility type data, maximum quantity data wherein said generation means is arranged to output quantity data associated with an item of utility type data for a step within a simulation determined by incrementing or decrementing quantity data associated with said utility type for the previous step in a simulation by the product of said generation rate data and said determining time increment step size only when said quantity data associated with said utility type does not exceed said maximum quantity data associated with said utility type.

37. (Currently Amended) An apparatus in accordance with claim 31, wherein said storage means is arranged to store in association with at least some of said plurality of processes, data indicative of [[a]] one or more continuation conditions, and said generation means comprises:

means for determining which of said plurality of processes are to be simulated in said step of said simulation; and

means for determining for processes to be simulated associated with data indicative of [[a]] one or more continuation conditions whether output data generated for

the previous step in said simulation fulfils the one or more continuation conditions defined by said data; and if ~~[[a]]~~ at least one continuation condition ~~for~~ associated with a process being simulated is not fulfilled by said generated output data simulating a delay in the continued processing of said process.

38. (Currently Amended) An apparatus for simulating an industrial process comprising:

storage means for storing model data indicative of a plurality of processes involving a number of items of equipment to be used in an industrial process to be simulated; and

generation means for generating output data indicative of a simulation of an industrial process utilizing said stored model data, ~~characterised~~ characterized in that said storage means is arranged to store ~~in association with at least some of said plurality of processes,~~ data indicative of ~~[[a]]~~ one or more continuation conditions in association with each of said processes, and said generation means comprises:

means for determining which of said plurality of processes are to be simulated in said step of said simulation;

means for determining for the processes to be simulated ~~associated with data indicative of a continuation condition whether~~ output data generated for the previous step in said simulation fulfils the one or more continuation conditions defined by said the stored data associated with said processes being simulated; and if ~~[[a]]~~ at least one

continuation condition associated with for a process being simulated is not fulfilled  
simulating a delay in the continued processing of said process.

39. (Original) An apparatus in accordance with claim 37, wherein said storage means is arranged to store data indicative of a continuation condition comprises data defining an equation which quantity data associated with utility type data is to fulfill.

40. (Currently Amended) An apparatus in accordance with claim 37, wherein said storage means is adapted to store data in association with each of said plurality of processes indicative of the next processes to be simulated following the completion of each said process wherein said means for determining of which of said plurality of processes are to be simulated comprises the steps of:

means for determining for each process simulated in the previous step of a simulation whether the ~~completion~~ one or more continuation conditions associated with each said process being simulated have ~~has~~ been fulfilled; and

means for determining as processes to be simulated; processes being simulated for which ~~said~~ not all of the continuation ~~completion~~ conditions have ~~not~~ been fulfilled and ~~said~~ the processes identified by data in said storage means as next processes to be simulated which are associated by said data with processes for which said completion conditions have been fulfilled.

41. (Original) A method in accordance with claim 1, wherein said determination of scheduling data further comprises the steps of:

when a batch is being initiated determining time remaining in a current shift and re-scheduling said batch if said time remaining is less than an estimated time required for processing said batch.

42. (Currently Amended) A method in accordance with claim 41, wherein ~~aid-~~ said re-scheduling of said batch comprises re-scheduling said batch for the next shift if said time remaining is less than a minimum processing time for said batch.

43. (Original) A method in accordance with claim 41, wherein said estimated time required is determined by calculating the sum of the greater of the greatest time of use of items of equipment utilized in processing said batches and minimum possible processing times for processing said batch in accordance with said model data for said items of equipment.

44. (Original) An apparatus in accordance with claim 22, wherein said determination means for determining scheduling data is operable when a batch is being initiated to determine time remaining in a current shift and re-schedule said batch if said time remaining is less than an estimated time required for processing said batch.

45. (Original) An apparatus in accordance with claim 44, wherein said re-scheduling of said batch comprises re-scheduling said batch for the next shift if said time remaining is less than a minimum processing time for said batch.

46. (Original) An apparatus in accordance with claim 44, wherein said estimated time is determined by calculating the sum of the greater of the greatest time of use of items of equipment utilized in processing said batches and minimum possible processing times for processing said batch in accordance with said model data for said items of equipment.

47. (Currently Amended) A recording medium, storing computer implementable processor steps for performing a method in accordance with any one of claims 1, 9 or 18 to 20 or 42 to 43.

48. (Currently Amended) A recording medium storing computer implementable processor step for generating within a programmable computer an apparatus in accordance with any one of claims 22, 30 or 38 to 40 or 44 to 46.

49. (Original) A recording medium in accordance with claim 47 comprising a computer disc.

*method  
claims*

50. (Original) A recording medium in accordance with claim 47, comprising an electric signal transferred via the Internet.

51. (Original) A computer disc in accordance with claim 49, wherein said computer disc comprises an optical, magneto-optical or magnetic disc.